Emerging Technologies in the 21st Century

A Summary of Final Reports

Prepared by
Stakeholder Technology Branch

April 2008

Alberta
Education

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Emerging Technologies in the 21st Century: A Summary of Final Reports

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1. Executive Summary

Alberta Education uses Calls for Proposals for technology innovation to support jurisdictions as they pilot new technologies and innovative practices. School jurisdictions participating in these projects become Alberta Education's research partners in examining new ways of using technology in teaching and learning. The one-time funding that is provided for these projects is targeted towards achieving the outcomes in the jurisdiction's research proposal, and the information is shared across the education system to provide all jurisdictions with information on best practices for technology implementation.

In November 2005, Alberta Education's Stakeholder Technology Branch issued a Call for Proposals on the subject of "Emerging Technologies in the 21st Century." Sixteen jurisdictions participated in one-year Emerging Technologies projects, of which 14 are discussed in this report. These projects were completed between April 2006, and August 2007.

Wireless Local Area Networks (WLANs) and Mobile Devices (Seven projects)

Wireless Local Area Networks (WLANs) are used to allow wireless devices (laptops, handhelds, etc.) to communicate with local resources and the Internet. Seven jurisdictions—Calgary Board of Education, Edmonton Public Schools, Evergreen Catholic Separate Regional Division, Grande Prairie Public School District, Red Deer Catholic Regional Division, and Rocky View School Division—and a charter school, Calgary Science School, implemented WLAN and mobile device pilot projects. The jurisdictions that implemented wireless and mobile computing projects reported results in four general areas: student work and achievement, student learning and engagement, teachers and teaching practice, and technology and technical support. These jurisdictions also provided recommendations, which are summarized below.

Student work and achievement

- Jurisdictions found that participating classrooms showed increases in the quantity and quality of written work being done by students; that students were not experiencing a heavier workload, just a different type of work; and that students showed improvement in the quality of their research.

Student learning and engagement

- The most widely reported effect was an improvement in the amount and quality of communication, collaboration, and organization amongst and between students and teachers.
- Many jurisdictions also reported that their wireless learning projects resulted in an increase in inquiry-based and self-directed learning. For example, one jurisdiction noted that students were more aware of their own progress and directed their own learning. Another jurisdiction noted that the technology allowed students to find their own information to solve problems.
- An increase in student engagement was another widely reported result of the implementation of wireless initiatives. Five jurisdictions included engagement-related outcomes in their reports. Teachers remarked that students enjoyed using the laptops; that classroom management

became easier with more students on-task; that the laptops seemed to alleviate some behavior problems; and that students gained a deeper understanding of the subjects they studied.

- Teachers remarked that the laptops enabled teachers to better understand and accommodate students' individual needs. One jurisdiction noted that its project helped to bring about a more student-centered approach in classrooms, and that invisible differentiation became possible.

Teachers and teaching practice

- The final project reports all emphasized how important effective professional development was in maximizing positive project outcomes. One jurisdiction noted that professional development on technology use was deemed more relevant by teachers when the technology was in more regular use in the classroom. Similarly, another jurisdiction emphasized the importance of professional development that coincides with implementation.
- Another widely reported effect is on teaching practice and teacher attitudes. Jurisdictions remarked that the technology project encouraged teachers to re-examine their practice and to become more student-centered, or to "give up control;" changed teachers' own beliefs about the effectiveness of the technology and their ability to use it; and that the use of technology gave teachers license to experiment.
- As remarked in the previous section, a vast majority of the jurisdictions remarked on how their projects promoted collaboration and communication. This change was seen in teachers' interactions with each other, as well as with students. For example, one jurisdiction observed that its wireless project facilitated collaborative teacher development of behavior rubrics, comment banks and parent letters. Another noted that in its project, teachers worked in interdisciplinary professional learning communities.

Technology and technical support

- One of the themes that emerged from the reports was the importance of technical support. Several jurisdictions remarked on how effective technical support made their initiatives successful, while other jurisdictions struggled with implementation and maintenance challenges because of insufficient technical support.

Recommendations

- A focus on professional development was a recurring theme in many of the jurisdictions' recommendations. One jurisdiction suggested that consistent training helps build continuity and teacher capacity. Several other jurisdictions remarked in general terms on the importance of professional development for the success of their projects.
- One jurisdiction observed that attempting to implement wireless projects at the same time as other initiatives created a greater need for technical support than IT staff could meet. One jurisdiction experienced problems with implementation, and suggested that all labs be fully tested and functioning before the beginning of the semester to promote seamless integration.

Voice over Internet Protocol (VoIP) (Three projects)

Voice over Internet Protocol (VoIP) enables the transmission of voice packets across the Internet, local area network, or wide area network. This allows for the convergence of voice, video data, and fax onto a single network and reduces the need for public switched telephone network use. VoIP systems also allow for the creation of infinite internal phone numbers and lines, which can create opportunities for jurisdictions to supply a wider variety of phone services to staff. Alberta jurisdictions are a particularly apt environment for the adaptation of VoIP technology because the SuperNet provides built-in Quality of Service protocols that enable guaranteed packet delivery. Three jurisdictions implemented pilot projects using VoIP technology – Battle River School Division, Foothills School Division, and Horizon School Division. Because of the nature of VoIP projects, most of these projects' outcomes were specifically related to cost savings and organizational efficiency.

Cost Savings

- Cost savings is one of the primary motivations for installing VoIP systems. All three jurisdictions reported cost-related outcomes from their VoIP projects. They remarked on the fact that removing land-line phones and/or the elimination of long distance fees created cost savings. One jurisdiction reported that by the end of its VoIP implementation, the district was saving $1,275 per month from a reduced number of phone lines. Another jurisdiction reported that its VoIP implementation saved the district $2,800 per month. These sums do not include long distance savings.
- In some cases, jurisdictions also found that their VoIP installations had unexpected costs. One found the cost of implementing district voice mail prohibitive. Another remarked that many additional features could be implemented in VoIP installations, but that these features could lead to unexpected costs.

Organizational Efficiency and Communication

- Jurisdictions experienced positive results in improved organizational efficiency and communication. One jurisdiction found that its VoIP system allowed for more effective call transfers, including transfers between individuals and between schools; that contact numbers became easier to organize; that the phones could all be updated from one central site; and that the system was very flexible and could be customized based on need.
- Two jurisdictions remarked that their VoIP systems facilitated better communication with parents, particularly because VoIP systems can potentially give each teacher his/her own voice mailbox. One jurisdiction also said that its VoIP system, with its infinite number of internal lines, improved communication between division office staff, principals, secretaries, and teachers.

Integration with Existing Systems

- All three jurisdictions remarked that their VoIP projects integrated with current phone and other technology systems. One pointed out that its VoIP phone system can be used to access the intercom system.

Recommendations

- One jurisdiction suggested that careful consideration be given to what features will be implemented in a VoIP system for maximum cost savings and usefulness.
- Implementing VoIP one school at a time was suggested for easier installation, training and troubleshooting.
- One jurisdiction suggested careful planning of all aspects of a VoIP implementation, including network traffic analysis, traffic management strategies, bandwidth implications, and technical expertise for installation and maintenance.
- Multiple jurisdictions suggested using a number other than '9' for outside lines to avoid confusion over calling emergency services.
- All three jurisdictions emphasized that thorough planning for customization, installation, training and technical support as the keys to successful VoIP installations.

Web-based Collaboration Tools, Administrative and Application Infrastructure (Three projects)

Web-based collaboration tools support efficient communication and collaboration between students, teachers, and administrators. They provide a variety of functions, including sharing of online resources, web publishing, and access to specific applications like e-mail and instant messaging. Three jurisdictions implemented emerging technologies projects using web-based collaboration tools, administrative and application infrastructure. These three jurisdictions—Edmonton Catholic Schools, Peace Wapiti School Division, and Pembina Hills Regional Division—completed a diverse range of projects in this area, including a district-wide portal for teachers and students, a student information system that was adopted by other jurisdictions, and a shared anti-SPAM e-mail system. Because of the diversity of these projects, outcomes and recommendations are specific to each jurisdiction. A detailed project summary for each jurisdiction's project is available in Section 4.

Leadership in Technology Integration in 21st Century Schools (One project)

The successful implementation of emerging technologies requires effective leadership skills. Individuals in leadership positions are fundamental in creating organizational culture and policies that support and sustain innovative uses of technology for teaching and learning. Only one jurisdiction, Calgary Catholic Schools, undertook a project in this area and developed a Technology Leadership Program and a Technology Learning Centre, which have offered support for the development and implementation of other technology-based learning programs in this jurisdiction's schools. More information on this technology leadership project, including outcomes and recommendations, is available in Section 4.

Conclusion

Almost all jurisdictions, in spite of the great variety of projects undertaken, reported on the importance of adequate professional development and technical support. In some cases, jurisdictions attributed the success of their projects to these factors. Many jurisdictions reported that their projects' success hinged on giving teachers and other staff effective strategies and support for integrating technology to support learning in classrooms. In other cases, jurisdictions felt that their projects could have been more successful with the integration of additional professional development and technical support.

One general theme that emerged from many jurisdictions' reports is that technology projects were most successful when the emphasis was on using technology to meet pedagogical goals, as opposed to using technology for its own sake. Other widely reported recommendations for future emerging technologies projects included the following:

- More extensive project and implementation planning;
- More extensive research and testing of hardware and software before implementation;
- Ensuring robust and dependable systems to encourage a culture of use; and
- Changes in policy to support effective technology integration.

These one-year projects provided preliminary, short-term research in emerging technologies in schools and mainly examined technology implementation issues. Longer-term and more extensive research will be needed to fully investigate the impact these technologies can have on education in Alberta. All of the research findings from the jurisdictions participating in Emerging Technologies in the 21st Century projects will be useful in planning future technology projects in Alberta schools.

2. Background

Alberta Education uses Calls for Proposals for technology innovation to support jurisdictions as they pilot new technologies and innovative practices. School jurisdictions participating in these projects become Alberta Education's research partners in examining new ways of using technology in teaching and learning. The one-time funding that is provided for these projects is targeted towards achieving the outcomes in the jurisdiction's research proposal, and the information is shared across the education system to provide all jurisdictions with information on best practices for technology implementation.

In November 2005, Alberta Education's Stakeholder Technology Branch issued a Call for Proposals on the subject of "Emerging Technologies in the 21st Century." Publicly funded school jurisdictions and charter schools were invited to submit proposals to pilot emerging technologies to support the delivery and enhancement of teaching, learning and administrative systems. These projects could employ the following technologies:

- Wireless Local Area Networks (WLANs) and mobile computing devices;
- Voice over Internet Protocol (VoIP); and
- Web-based collaboration tools, administrative and application infrastructure.

Proposals could also be submitted for projects in a fourth area:

- Enhancing skills and competencies of school and jurisdiction administrators to provide leadership in technology integration in 21st century schools.

Where applicable, jurisdictions could partner with other K-12 jurisdictions, post-secondary institutions, and non-profit content providers. Several jurisdictions partnered with other school districts, professional development organizations, vendors, and post-secondary institutions.

For the purposes of this initiative, "emerging technologies" were defined in the Call for Proposals as "any technology that is not yet a 'must have.' However, emerging technologies offer the potential to add value and benefit to the education system by creating efficiencies and effectiveness related to student learning, teacher productivity and enhancing administrative systems." The Call for Proposals also emphasized that the Alberta SuperNet provides education system stakeholders with a high-capacity broadband network that can support the delivery of voice, video and other broadband data applications across the province. New and emerging technologies, combined with the capabilities of the SuperNet, can transform the learning process, foster innovation, and allow for continuous improvement to ensure high quality learning experiences for students. Videoconferencing projects were not funded as part of this initiative, as another Call for Proposals (in August, 2005) was already facilitating research in the use of videoconferencing in teaching and learning.

The Emerging Technologies Call for Proposals was intended to support strategies in Alberta Education's 2005-2008 Business Plan, namely:

- Strategy 1.4: "To focus on new technologies to increase program choice and access for students in rural communities;" and

- Strategy 1.5: "To enrich and expand student learning opportunities through the continued implementation of the Learning and Technology Policy Framework, including the Alberta SuperNet, LearnAlberta.ca, technology standards and solutions, and related research."

This call for proposals was also intended to support the Learning and Technology Policy Framework, which encourages the identification, evaluation, and potential adoption of emerging technologies and promising practices that will improve student learning and expand learning opportunities for all Albertans.

Project proposals were due in December, 2005. The proposals received were evaluated on the basis of a wide range of criteria, including adherence to proposal requirements, feasibility of the project proposed, and project management components. A total of 16 proposals were approved for funding.

These one-year projects were carried out in the 2006/2007 school year, between April 2006 and August 2007. Final reports from all participating jurisdictions were due in November 2007. Participating jurisdictions were also required to host site visits from Alberta Education personnel, participate in research and knowledge sharing activities coordinated by Alberta Education, and provide interim and final reports. All of the jurisdictions participating in Emerging Technologies in the 21st Century projects presented their findings at at least one Jurisdictional Technology Contact (JTC) event to facilitate information-sharing. These presentations occurred at the May 2006 and November 2007 JTC events. As well, all participating jurisdictions included sustainability planning in their final reports to ensure that the infrastructure implemented in this project continues to benefit students and staff.

Two participating jurisdictions, Wolf Creek School Division and Palliser Regional Schools, are not considered in this document, as these jurisdictions experienced delays in their projects' implementation, which led to delays in report submission. Palliser completed a technology leadership project, while Wolf Creek's project was investigating a VoIP solution. When these two jurisdictions report back on their projects, an appendix will be added to this document with information about those projects.

The successful respondents to this Call for Proposals are listed in the table below in alphabetical order by theme. Funding was provided in the range of $35,000 to $150,000, although some projects' budgets (including jurisdictional funding) exceeded $150,000. The average budget for these projects was $127,500. In total, $2,040,000 was disbursed in Emerging Technologies in the 21st Century project funding.

Theme 1: Wireless Local Area Networks (WLAN) and Mobile Computing Devices

District	*Project Title*	*Project Description*	*See p.*

- Strategy 1.5: "To enrich and expand student learning opportunities through the continued implementation of the Learning and Technology Policy Framework, including the Alberta SuperNet, LearnAlberta.ca, technology standards and solutions, and related research."

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Theme 1: Wireless Local Area Networks (WLAN) and Mobile Computing Devices			
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District	*Project Title*	*Project Description*	*See p.*
Calgary Board of Education	Emerging Technologies in the 21st Century: Wireless Learning Project	Investigated the impact of technology on learners in two different school settings where technology is ubiquitous and students were able to access digital tools and learning resources on-demand.	14
Calgary Science Charter School	Teaching and Learning in a One-to-One Mobile Computing Environment	Implemented a one-to-one laptop initiative in partnership with Galileo Educational Network Association and Apple Canada to evaluate educational benefits of wireless technology and portable laptops for 100 students over a period of four years (Grades 6 to 9).	18
Edmonton Public Schools	The Role of Wireless Computing Technology in Edmonton Public Schools	Explored the effects of one-to-one access on student achievement, developed a community of practice to support the use of multiple wireless technologies, and expanded the use of this technology in Edmonton Public Schools.	21
Evergreen Catholic Separate Regional Division	Using a Wireless Mobile Computer Lab to Support the Teaching and Learning Process	Supported teachers working in a professional learning community by integrating technology into the curriculum through a wireless mobile computing lab.	23
Grande Prairie Public School District	In An Air of Excellence	Investigated the benefits of a mobile lab in the high school settings by increasing the use of wireless and mobile technologies. Examined and explored how writing achievement could be influenced by the use of wireless laptops.	25
Red Deer Catholic Regional Division	Leadership in a Wireless World	Focused on establishing two wireless local area networks and mobile laptop labs. The first lab was implemented within a school setting, and focused on teacher pedagogy and technology integration in the classroom. The second site was implemented at the central office, and supported administrator/technology leadership sessions.	27

District	*Project Title*	*Project Description*	*See p.*
Rocky View School Division	Learning Anywhere – Anytime	Examined WLAN and mobile devices to enrich delivery and expand student learning opportunities. Targeted six school sites and engaged 24 teachers and 450 students through the use of multiple technologies.	29
Theme 2: Voice over Internet Protocol (VoIP)			
District	*Project Title*	*Project Description*	*See p.*
Battle River School Division	Communication in the 21st Century	Expanded current VoIP solution to link nine more schools within the jurisdiction. Focused on enhancing parent-school communications, operational cost savings, and the synchronization of school clocks and bells.	32
Foothills School Division	IP Convergence	Expanded on the jurisdiction's Cisco VoIP solution to new sites, including a converged solution in providing voice, media, intercom and bell systems over IP.	35
Horizon School Division	Implementing Voice over IP Technologies to Enhance Collaboration of Teachers, Administrators and Parents in the Horizon School Division	Implemented a core VoIP system infrastructure to support the addition of incremental features and systems as schools are modernized in phases over time.	37
Wolf Creek School Division	Creating Powerful VoIP Communications Infrastructure	Implemented an enterprise VoIP solution throughout the jurisdiction. Project goals included establishing a five-digit dialing schema within the jurisdiction, exploring the potential of voice telephones in every classroom and voice mail for every teacher as a means of improving school-to-home and home-to-school communications, and investigating the merits of inter-jurisdictional VoIP communications with Pembina Hills School Division using SuperNet. *Final report forthcoming*	n/a

Theme 3: Web-based Collaboration Tools, Administrative and Application Infrastructure			
District	*Project Title*	*Project Description*	*See p.*
Edmonton Catholic Schools	Web-Based Learner Outcome Assessment	Developed a universal interface that provided other districts with access and use of web-based student assessment software, Individual Program Plans, and e-report cards.	40
Peace Wapiti School Division	Peace Region Education Portal (PREP)	Implemented a portal to address the district's need for access, accountability, and efficiency in teaching and learning.	43
Pembina Hills Regional Division	Anti-Spam Technology as a Shared Service over SuperNet	Used SuperNet to provide anti-spam technologies for partner jurisdictions to reduce the amount of unsolicited e-mail.	45
Theme 4: Leadership in Technology Integration			
District	*Project Title*	*Project Description*	*See p.*
Calgary Catholic Schools	Technology Leadership Program (TLP) & Technology Learning Centre (TLC)	Implemented a technology leadership program (TLP) for 30 identified district leaders. The TLP allowed leaders to be involved in intensive professional development for technology leadership.	47
Palliser Regional Division	Building IT/ICT Capacity: An Alberta Solution	Conducted a study and developed accompanying resources for effective Information Technology leadership within partner school jurisdictions. *Final report forthcoming*	n/a

These one-year projects provided preliminary, short-term research in emerging technologies in schools. These projects were mainly an examination of technology implementation issues. Longer-term and more extensive research will be needed to fully investigate the impact these technologies can have on education in Alberta. As well, the information provided is limited by the qualitative nature of the information provided by school districts.

3. Purpose

The purpose of this summary report is to share the findings of 14 jurisdictions participating in the Emerging Technologies in the 21st Century initiative, as detailed in their final reports submitted in November 2007. Interim reports and initial project proposals have also been reviewed for additional details in project implementation. As such, the information included in this document is based on reporting provided by jurisdictions. This report will summarize the completed projects, emphasizing lessons learned, outcomes, best practices, and recommendations. Recommendations have been provided by the participating jurisdictions and do not necessarily represent the views of Alberta Education.

3. Detailed Project Descriptions by Theme: Wireless Local Area Networks (WLANs) and Mobile Computing Devices

Calgary Board of Education

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Calgary Board of Education	Emerging Technologies in the 21st Century: Wireless Learning Project	Investigated the impact of technology on learners in two different school settings where technology is ubiquitous and students are able to access digital tools and learning resources on-demand.

Project Implementation

The Calgary Board of Education integrated one-to-one computing in four Grade 5 and 6 classrooms. Students used laptops for many tasks, including word processing; spreadsheets for science and math classes; creation and manipulation of digital media such as movies, photos and music; e-mail, wikis, and online research; accessing a learning management system; assistive technology, translation, and text-to-speech; and other applications. The four participating teachers were also each given a laptop for their own professional use.

This project examined how student learning was impacted when wireless technology was used to provide students with on-demand access to digital tools and resources. The project was designed to explore the value of wireless learning, to validate research findings related to one-to-one learning, and to guide subsequent one-to-one laptop projects. In particular, this project was an exploration of how one-to-one laptops would influence teachers' practice and students' attitudes, perceptions, motivation, enjoyment, and learning.

> "I type faster than I write, I can learn in different ways, I can describe photos or use them in learning and stuff like that. I can store a lot of things, easily organize them and find them in seconds. It's more fun and makes me work harder. And I can share things with my class and many others far easier." –A Calgary Board of Education

Outcomes

Results from this project included deeper understanding of technology implementation and its impact on both student learning and teacher practice. Specifically, these results included:

- An increase in the amount of writing students were creating;

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Outcomes

Results from this project included deeper understanding of technology implementation and its impact on both student learning and teacher practice. Specifically, these results included:

- An increase in the amount of writing students were creating;

- An increased need for, and increased understanding of, information literacy and its integration into the classroom on the part of both teachers and students;
- A move toward more personalized and tailored learning for all students;
- Greater awareness and appreciation of visual literacy concepts in day-to-day work;
- Increased levels of meta-cognition, reflective thinking, reflective writing and data collection/analysis on the part of students;
- A greater empowerment for the use of multiple forms of representation using technical or non-technical means;
- A greater understanding of the proper and ethical use of computers and information, as well as the need for active teaching in these areas;
- The increased integration of technology to enhance inquiry-based learning;
- The use of organizational and communication tools for collaboration between students, between teachers and between students and teachers;
- A higher level of understanding of individual students' identities as learners; and
- A re-examination of teaching practices, in particular, increased personalization of curriculum.

> "One-to-one computing has simply become part of our work and the students' learning. It has become a true seamless tool... We have learned to let students use them when they need them, although we often talk about making sure they are used for the right reasons." –A Calgary Board of Education teacher

The following chart shows the online survey responses from the four teachers who participated in this project.

Question	Strongly agree	Agree	Somewhat agree	Somewhat disagree	Disagree	Strongly disagree
"Overall, I believe the incorporation of wireless laptops into the classroom has been a positive experience for myself."	3	1	0	0	0	0
"Overall, I believe the incorporation of wireless laptops into the classroom has been a positive experience for the students."	2	2	0	0	0	0
"I believe the use of wireless laptops has had a positive	2	2	0	0	0	0

Question	Strongly agree	Agree	Somewhat agree	Somewhat disagree	Disagree	Strongly disagree
effect on my students' schoolwork."						
"I required a significant amount of technical support in order to properly incorporate wireless laptops into the classroom."	2	1	1	0	0	0
"I believe the use of laptops has created a better learning environment for my students."	0	2	1	0	0	0
"I faced very few obstacles to incorporating wireless laptops into the classroom."	1	0	1	2	0	0

The following chart shows students' responses to an online survey conducted in June 2007, after the completion of the project. 109 students completed this survey.

Question	Strongly agree	Agree	Sort of agree	Sort of disagree	Disagree	Strongly disagree
"Overall, having my own laptop was a positive experience."	68.8%	26.3%	3.8%	1.3%	0%	0%
"My schoolwork improved by having my own laptop to use."	38.8%	43.8%	11.3%	6.3%	0%	0%
"I enjoyed school more because I had my own laptop."	38.8%	25%	21.3%	10%	1.3%	3.8%
"I enjoy going to school."	31.3%	36.3%	21.3%	2.5%	3.8%	5%
"I needed a lot of help using my laptop."	5%	6.3%	27.5%	18.8%	31.3%	11.3%

Question	Strongly agree	Agree	Sort of agree	Sort of disagree	Disagree	Strongly disagree
"Having my own laptop had NO effect on my school work."	3.8%	6.3%	6.3%	1.3%	30%	52.5%

Recommendations

Based on this project, the Calgary Board of Education identified the following five critical success factors for a wireless/mobile computing project:

1. A robust WLAN that can provide adequate bandwidth to support full class utilization of user technologies.
2. Appropriate teacher professional development for infusing of laptops into curricular outcomes.
    - Specifically, the Calgary Board of Education emphasized the importance of professional development targeted to the specific needs of the school, teachers, and students. Its report clarified that all professional development was specifically done around teaching and learning and enabling 21st century skills and understandings for students, not about the use of the technology itself. The support provided by the vendor tended to be more about the use of the technology and the software in general, rather than teaching and learning. The Calgary Board of Education emphasized that the perception of support was extremely important to the success and comfort of teachers.
3. Appropriate technical support is available for project teachers and their learners.
4. Learning is enhanced by this project.
5. Appropriate hardware is available for one-to-one ratios to be achieved.

Calgary Science Charter School

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Calgary Science Charter School	Teaching and Learning in a One-to-One Mobile Computing Environment	Implemented a one-to-one laptop initiative in partnership with Galileo Educational Network Association and Apple Canada to evaluate educational benefits of wireless technology and portable laptops for 100 students over a period of four years (Grades 6 to 9).

Program Implementation

The Calgary Science School collaborated with the Galileo Educational Network Association (GENA) to prepare and implement the Personalized Learning Initiative program. The Personalized Learning Initiative proposal outlined Calgary Science School's plan to implement a one-to-one mobile technology program using MacBook laptop computers. The project included Grade 6 students and teachers in the 2006/2007 school year. Students were able to use their individual laptops throughout the year, at home as well as in school. In order to raise awareness of the program and to make expectations clear, parents were asked to attend an evening information session.

The Calgary Science School's mobile computing project was seen as a natural extension of the school's focus on inquiry-based learning and on integrating technology. The school has focused on technology integration in other ways, including dedicated laptop computers for teachers and a full-time educational technologist position. This project was perceived as an opportunity for the Calgary Science School to research one-to-one initiatives and better understand how student learning would be impacted by immersion in a well-designed, well-supported, one-to-one mobile technology-enabled environment.

Outcomes

Calgary Science School reported the following six key findings from their study of mobile computing:

- Students become knowledge builders when technology is properly implemented. Calgary Science School's report stated that "students were invited to try things out, experiment, and refine their understanding as they received constant and immediate feedback;"
- Teachers require time to learn with and from each other as well as personalized professional learning opportunities;
- Authentic inquiry-based work increases student engagement. The Calgary Science School found that the mobile computing environment allowed greater flexibility in the type and variety of tasks students were engaged in, and that students were more engaged with their work;
- The effective use of technologies requires different pedagogical and assessment strategies. Teachers developed new practices related to flexible work spaces, multiple means of expression, time use, connecting with experts, and authentic intellectual work. Assessment practices also

Calgary Science Charter School

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Calgary Science Charter School	Teaching and Learning in a One-to-One Mobile Computing Environment	Implemented a one-to-one laptop initiative in partnership with Galileo Educational Network Association and Apple Canada to evaluate educational benefits of wireless technology and portable laptops for 100 students over a period of four years (Grades 6 to 9).

Program Implementation

The Calgary Science School collaborated with the Galileo Educational Network Association (GENA) to prepare and implement the Personalized Learning Initiative program. The Personalized Learning Initiative proposal outlined Calgary Science School's plan to implement a one-to-one mobile technology program using MacBook laptop computers. The project included Grade 6 students and teachers in the 2006/2007 school year. Students were able to use their individual laptops throughout the year, at home as well as in school. In order to raise awareness of the program and to make expectations clear, parents were asked to attend an evening information session.

The Calgary Science School's mobile computing project was seen as a natural extension of the school's focus on inquiry-based learning and on integrating technology. The school has focused on technology integration in other ways, including dedicated laptop computers for teachers and a full-time educational technologist position. This project was perceived as an opportunity for the Calgary Science School to research one-to-one initiatives and better understand how student learning would be impacted by immersion in a well-designed, well-supported, one-to-one mobile technology-enabled environment.

Outcomes

Calgary Science School reported the following six key findings from their study of mobile computing:

- Students become knowledge builders when technology is properly implemented. Calgary Science School's report stated that "students were invited to try things out, experiment, and refine their understanding as they received constant and immediate feedback;"
- Teachers require time to learn with and from each other as well as personalized professional learning opportunities;
- Authentic inquiry-based work increases student engagement. The Calgary Science School found that the mobile computing environment allowed greater flexibility in the type and variety of tasks students were engaged in, and that students were more engaged with their work;
- The effective use of technologies requires different pedagogical and assessment strategies. Teachers developed new practices related to flexible work spaces, multiple means of expression, time use, connecting with experts, and authentic intellectual work. Assessment practices also

changed to reflect the changes laptops created in the classroom. Assessment practices included more opportunities for meaningful and timely formative assessment and feedback and peer- and self-assessment;

- Students' technological proficiency is underused in classrooms. On the basis of this project, the Calgary Science School report suggested that teachers design authentic tasks that require students to consider a full range of applications, pushing beyond what they currently use to increase the complexity of learning and levels of student engagement; and
- The Personalized Learning Initiative requires clear processes for determining progress towards achieving the shared vision. Calgary Science School emphasized the importance of relating practice to existing policy and vision documents.

Recommendations

The report from Calgary Science School made the following recommendations based on the outcomes of its project:

1. In the context of the school's vision for inquiry and technology, clear processes and procedures for implementing and sustaining the Personalized Learning Initiative need to be established to ensure a strong culture of use. Calgary Science School suggests that further effort is required on the part of the school administration to develop a clear direction for technology integration that is grounded in pedagogy. It notes that a direction for further development will be in ensuring that the vision for technology use in the Personalized Learning Initiative is clearly understood, that all stakeholders are committed to achieving it, and that there is a cohesive process in place to evaluate progress.
2. As the Personalized Learning Initiative continues to grow and expand, more intentional processes and protocols for teacher professional development are needed to build a strong professional learning community as well as responsive personalized learning opportunities. Calgary Science School teachers reported that they required professional development on technology itself, on how to use it and on how to teach with it. Some teachers also expressed interest in self-directed professional development. In all cases, teachers required clear processes and protocols for evaluating their own progress. As Calgary Science School's report states, "teachers need pressure and support in becoming knowledge builders themselves."
3. Greater use of online, collaborative knowledge building environments (Web 2.0) should be encouraged within the Personalized Learning Initiative. The Calgary Science School recommends that online collaborative technologies be used to extend and enhance knowledge building.

> "Projects that worked really well were structured investigations where the kids are given some freedom in what it is they want to find out, when they were given some support in best places to find that information. Students are all at different levels with the ability to remain focused in their research, but I know that the activities that allow them to investigate questions that they have or questions that we've come up with as a class have been really successful. They're motivated because they want to know." –A Calgary Science School teacher

4. Establish feedback loops and processes so that evidence-based decisions continue to inform and drive the Personalized Learning Initiative. This recommendation focuses on the establishment and use of ongoing evaluation of technology for learning, communication, and productivity. Clear timelines, tracking processes, and communication systems must be intentionally built into the design of the Personalized Learning Initiative in order to ensure the success of the initiative.
5. Continued commitment on the part of the Calgary Science School to support ongoing research on the impact of the Personalized Learning Initiative. Calgary Science School recommends ongoing research to assess the effectiveness of new approaches using technology to improve teaching and learning.

Edmonton Public Schools

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Edmonton Public Schools	The Role of Wireless Computing Technology in Edmonton Public Schools	Explored the effects of one-to-one access on student achievement, develop a community of practice to support the use of multiple wireless technologies, and expanded the use of this technology in Edmonton Public Schools.

Project Implementation

Edmonton Public Schools' project was designed to integrate wireless technology to enhance student achievement, to empower educators in the implementation of curriculum, and to expand and promote the use of wireless technology in Edmonton Public Schools. The district also aimed to establish a community of practice to support the implementation and long-range plans for wireless technology. Teachers received laptops the summer before the implementation to familiarize themselves with the technology. Laptops, projectors, printers, and laptop carts were purchased and implemented in three schools. In the first school, a Grades 5/6 spilt class composed of approximately 30 students had one-to-one access to laptops. In the second school, approximately 120 elementary school students had access to the computers in a mobile lab for all subjects. In the third school, approximately 600 junior high students had access to a science mobile lab. Wireless infrastructure was implemented throughout the three participating schools. Edmonton Public Schools also explored the construction of custom laptop carts equipped with access points, although the product of this design process was not found to be feasible.

The schools participating in this project had some success with a Students Willing to Assist with Technology (SWAT) team, consisting of Grade 6 students who were trained to set up and assist younger students with the laptop carts. Several community of practice events were held, and an online community was established, which included administrators, teachers, and technical support staff from three schools. Professional development was also carried out to aid teachers in their adaptation of this new technology.

> "This has definitely empowered [students] a great deal, and they are much more independent and self-directed. They are forever coming and showing me new things, challenging themselves in different ways, so in that sense the laptops have had a huge impact." - Grade 6 teacher from Glenora Elementary School

Outcomes

Edmonton Public Schools conducted research on the outcomes of its project, including online student surveys, classroom observations, teaching journaling, and focus-group interviews with teachers and students. The outcomes it reported include:

- Teachers' perceptions of the effectiveness of

technology changed;

- Teaching style changed to a more student-centered approach, and teachers were more willing to give up control in the classroom;
- Teachers were involved in more collaborative planning;
- Invisible differentiation became possible;
- Teachers were more aware of students' progress at any given time, and students were more aware of their own progress. Students also were more willing to accept feedback and edit their work;
- Classroom management became easier as students were more on-task. Students seemed engaged by the technology, as 95% of students reported that "using a laptop for learning makes school more interesting;"
- Students were more inclined to direct their own learning, and also to collaborate with each other and with teachers;
- The quantity and quality of student writing improved;
- Students reported that they felt they were more organized and were learning more as a result of having access to laptop computers and wireless Internet;
- 89% of students reported that the types of activities they did with the laptops were different from the types of activities they did in the computer lab; and
- Survey data indicated that students gained a significant benefit from increased access at school, but not necessarily from the ability to take laptops home. 44% of students reported no difference resulting from taking laptops home.

Recommendations

Edmonton Public Schools' final report emphasized two main aspects of the project that it felt ensured its success:

1. Reliable access is key in creating sustainable wireless computing environments. Without it, "teachers will become frustrated and stop planning for the integration of technology." The robust wireless infrastructure installed at each of the project schools allowed for remote management and troubleshooting and reliable connectivity. In this case, the project also benefitted from using the same hardware and software at multiple sites to keep costs down and make technical support easier.
2. Providing a sense of community for staff members who are implementing technology is necessary. Most of the teachers involved in this project agreed that day-to-day, informal collaboration with colleagues was the best professional development they had. They also indicated that access to the online community provided was helpful. In addition, allowing for the involvement of technical support staff in the community of practice improved communication.

Evergreen Catholic Separate Regional Division

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Evergreen Catholic Separate Regional Division	Using a Wireless Mobile Computer Lab to Support the Teaching and Learning Process	Supported teachers working in a professional learning community by integrating technology into the curriculum through a wireless mobile computing lab.

Project Implementation

Evergreen Catholic Separate Regional Division installed a wireless mobile computing lab of 30 student machines and one teacher station with a projector at one school. Over 400 students had access to this mobile lab. During the course of the project, Evergreen investigated the following possibilities to establish its wireless infrastructure and associated professional practice:

- Wireless LAN infrastructure through the implementation of "access points" to provide mobility and access for students and staff with mobile devices;
- Implementation of wireless infrastructure and related supports to enhance the teaching and learning process within an older school;
- WLANs and related security management strategies to address network privacy and protection;
- Recommendations for the effective choice of a wireless mobile computer lab;
- Teachers working in professional learning communities to integrate technology meaningfully into the curriculum, learning technology skills that will enable them to infuse technology into the curriculum; and
- Posting of lesson plans and exemplars of student work to share with other teachers across the jurisdiction and the province.

Evergreen experienced some initial challenges with stability and security of access. Employing access points alone left the network with security vulnerabilities, and the network often could not handle all 30 laptops. The jurisdiction's initial attempt to have wireless access points travel with the laptop cart proved unsuccessful. There were insufficient wired connections in classrooms to connect the portable access points, which caused difficulty for teachers without the technological skills to locate and disconnect the wired network connection from their desktop computers. The initial units were replaced with a new permanent system, which did not move around with the laptop carts, and which offered consistent and secure wireless and improved connectivity.

The laptop units used in the Evergreen project were HP laptops with extended batteries. These HP Compaq Business Notebooks were chosen on the basis of style, size, battery life and cost. The district also selected a wireless cart for use with its mobile lab, a Datamation cart, which was chosen for its built-in recharging capabilities and its design.

Outcomes

Evergreen Catholic Separate Regional Division reported the following outcomes of its wireless/mobile computing implementation:

- Teachers embraced the notion of working in professional learning communities to develop lesson plans. Because of the collaborative aspect of lesson planning, this activity required a smaller time commitment from teachers;
- Teachers felt that they had a greater opportunity to use technology in their classrooms and learned new skills themselves. Some teachers added technology-related goals to their professional growth plans;
- Professional development sessions were held on the use of various software applications. Teachers from the participating school attended sessions on Windows MovieMaker, Microsoft Excel, GradeBook, Dreamweaver, and other programs; and
- Teachers felt that professional development on technology use was more relevant to them because they had more consistent access to technology for use in their teaching. St. Marguerite School was the first school in to install a wireless system and was able to lead the way for other schools.

> "It was a great learning experience. I love finding new ways to motivate my students. They like using the mobile lab, so they'll do the work involved in a bigger project." -An Evergreen teacher

Recommendations

Evergreen's recommendations are primarily related to the technical aspects of their project. Specifically, it recommends:

1. Using business-quality, rather than standard wireless units, to accommodate traffic and security.
2. Planning generously for wireless access points, particularly in facilities with concrete walls.
3. Conducting a complete wireless access survey to ensure connectivity.
4. Allowing lots of time for installation.

Evergreen also noted that its extra investment in wireless carts and laptop batteries was money well-spent.

In the evaluation component of this project, teachers ranked the following factors as having the most significant impact on effective technology integration:

- Access to working infrastructure;
- Personal skills; and
- Time and opportunities for collaboration with peers.

Grande Prairie Public School District

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Projcct Title*	*Project Description*
Grande Prairie Public School District	In An Air of Excellence	Investigated the benefits of a mobile lab in the high school settings by increasing the use of wireless and mobile technologies. Examined and explored writing how writing achievement could be influenced by the use of wireless laptops.

Project Implementation

Grande Prairie Public School District implemented a mobile laptop lab program in six Grade 6 classrooms, two classrooms in each of three schools. Approximately 150 students and seven teachers participated in the project. The In An Air of Excellence project was focused on improving the quality of students' writing, although the proposal suggested that improvements might occur in the following additional areas:

- Attendance;
- Students' self-evaluation skills;
- Student citizenship skills;
- Skills using technology; and
- Achievement in other subject areas.

In its proposal, Grande Prairie suggested that the motivational opportunities and integration of innovative software and equipment in classrooms would allow the high achievers to excel, and that the district would see an increase in the percentage of students achieving at a Standard of Excellence level.

Grande Prairie Public's emerging technologies project took place at the same time as other major updates to technology in the district, including a VoIP installation, implementation of new networks in 10 schools, and new computer hardware and software. Wireless networks were at least partly implemented at the three schools, although the implementation was limited by the need to extend the network to portables in one school.

Grande Prairie Public experienced a significant delay in project implementation, including delays in acquiring equipment and school wiring. The wiring of the schools was not completed until March 2007. Once implementation was complete, more wireless access points had to be purchased for the laptops to perform at a speed nearer to that of a desktop computer. Both staff and students reported frustration with implementation delays and technical difficulties. Teachers were also frustrated that their initial professional development took place two months before the equipment arrived. Grande Prairie Public reported that after solutions were found to these technical problems, the second year with the equipment (after the end of the project) was far more successful and enjoyable for staff and students.

Outcomes

Grande Prairie Public's project was not implemented early enough in the 2006/2007 school year to garner meaningful analysis of achievement test results. However, anecdotal evidence collected from teachers suggests that Grade 6 students' satisfaction levels were higher, as evidenced in improved attendance, greater time on-task, more positive peer interactions and a better climate for learning.

Recommendations

Grande Prairie Public School District made the following recommendations based on the outcomes of its wireless learning project:

1. Ensure that adequate resources are in place to support implementation. Grande Prairie Public indicated that its project took place at the same time as three other major divisional technology undertakings. As such, the IT department was not able to commit sufficient energy and time to implementation.
2. Hire an experienced company to complete site planning and implementation planning before implementing a new technology.
3. Focus the wireless infrastructure in the area of the school where it will be most needed and used.
4. Plan professional development to coincide with the actual implementation times, not the proposed dates. Professional development is more effective when delivered in a timely fashion. As well, teachers who work with the same students but who are not directly involved in the project can receive some technology training in order to ensure continuity and to increase teacher capacity.
5. Based on its own implementation, Grande Prairie Public suggests that placing shared laptops in close proximity to the classrooms where they are used may be a more cost-effective solution than one-to-one laptops. Teachers can schedule their lessons to make effective use of the technology, with sharing strategies varying from half-days to whole weeks, depending on the units being taught.
6. Laptops carts, when equipped with a printer and projector, are cumbersome and the process of moving them throughout the school was not effective.
7. Grande Prairie Public recommended the use of laptop management software to share screens or restrict access at various times in a lesson.
8. Informing parents and school administrators of the project and keeping them abreast of developments, including delays, helped to build support for the project.

Red Deer Catholic Regional Division

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Red Deer Catholic Regional Division	Leadership in a Wireless World	Focused on establishing two wireless local area networks and mobile laptop labs. The first lab was implemented within a school setting, and focused on teacher pedagogy and technology integration in the classroom. The second site was implemented at the central office, and supported administrator/technology leadership sessions.

Project Implementation

Red Deer Catholic Regional Division piloted wireless networks with mobile laptops at one elementary school and at the Division Central Office. The mobile lab at the elementary school was intended to supplement the existing computer lab and increase student access to technology. A shortage of classroom space and a growth in school population (to approximately 500 students) forced this school to maximize its use of non-traditional classroom areas. The wireless project at this school supported efforts to support learning with technology, by giving students "on time" access to technology in the classroom. The mobile lab at the Division Central Office was intended to support professional development being offered within the division, and the jurisdiction reports that there has been considerable demand for it.

Red Deer Catholic Regional Division experienced minor technical setbacks, including a delayed start date for the project due to problems with the laptops and wireless network. Specifically, Red Deer Catholic had problems with weak wireless signals, access codes, and security. It also found that there was a greater need for laptop batteries than anticipated, as the batteries have a limited lifespan.

Outcomes

Red Deer Catholic Regional Division reported the following outcomes from their mobile implementation at two sites:

- Increased student and teacher engagement in learning;
- Increased collaboration between teachers on behavior rubrics, achievement indicators, comment banks, and parent communication letters;
- The elementary school used its mobile laptop lab to implement an inquiry-based approach to the Social Studies curriculum. Its report noted that collaboration and communication between students have also been improved;
- Improved student enthusiasm and comfort using technology. Students gained greater confidence in their computer skills on a variety of applications, and they used computers for a wider variety of tasks;

- Students' research skills using technology have improved;
- Teachers felt that the technology gave them a license to experiment and stimulated them to think about the learning process;
- Expanded leadership capacity; and
- Professional development delivery was improved and expanded, including sessions on the ICT measures project, Grades 3 and 10 math learning guides, web-based elementary report card training, tech coach training, and sessions focused on how to integrate technology in the classroom.

Holy Family experienced an increase in the number of students reaching the Acceptable and Excellence levels in Grade 3 Math and English Language Arts Provincial Achievement Tests. It attributes this improvement in student performance in part to technology implementation. In particular, teachers took advantage of greater availability of technology to prepare students for the Provincial Achievement Test exams with computerized practice tests.

Recommendations

Based on its wireless project, Red Deer Catholic Regional Division makes the following recommendations:

1. Have mobile labs fully functioning and undergo testing before students are expected to use the computers in September.
2. Like several other divisions, Red Deer Catholic Regional Division experienced problems with wireless connectivity, and suggests using more access points to ensure a robust network.
3. Be aware of the need for technology support at the district level and the school level for successful implementation.
4. Be aware of logistical issues such as choice of laptop carts, storage location for carts when not in use, and a central booking system for mobile labs, and include these types of details in the initial project plan.
5. Red Deer Catholic Regional Division suggested that it would advise purchasing laptops that include built-in webcams, as this feature would expand the number of ways the laptops could be used.

Rocky View School Division

Wireless Local Area Networks (WLANs) and Mobile Computing Devices		
District	*Project Title*	*Project Description*
Rocky View School Division	Learning Anywhere – Anytime	Examined WLAN and mobile devices to enrich delivery and expand student learning opportunities. Targeted six school sites and engaged 24 teachers and 450 students through the use of multiple technologies.

Project Implementation

The Rocky View School Division's mobile technologies project consisted of WLANs and mobile computing devices at six schools. This project included 36 teachers and approximately 700 students in Grades 1 to 12. One facilitator was appointed to conduct the project research and to support the teachers and students with their pedagogical and technological needs. The technology in use included 35 MacBooks; 15 digital cameras, 5 digital video cameras with tripods; ten Wacom tablets; and a wireless network with laptop cart and wireless printer.

Rocky View experienced minor setbacks with its project implementation, including short-term problems with Internet connectivity and software implementation. The biggest complaint from teachers was the inability to connect to a school network for saving work. This problem was partly solved in the second semester with the use of USB memory keys. The final report indicated that Rocky View was extremely impressed with the MacBook laptops and associated software, especially iLife. The project facilitator notes, "I can confidently say now that the success of the project and the positive experience the students and teachers had with the MP Technologies was because we chose the MacBooks and the iLife software. The software is easy to use and becomes very intuitive." It found that the software and hardware chosen supported inquiry/project-based learning and multiple literacies, both of which were goals of the project stated in the initial proposal.

Outcomes

The following chart shows student responses to several of the questions in the online project survey. The initial (baseline) survey was completed by 540 students, some of them working in pairs. The end survey was completed by 412 students.

Question	Before Mobile Technology Project	After MT Project
"At school I use computers to help with my learning."	66% of students answered "all of the time" or "some of the time."	81% of students answered "all of the time" or "some of the time."
"When I use computers at school I am doing _____."	Keyboarding, word processing, and Internet searches.	Keyboarding, word processing, Internet searches, presentations, graphic design, video and audio production, photography.
"In the past ('semester' for the after survey) how often have you had the opportunity to use computers, digital cameras... to help with your learning?	8% answered "all of the time."	20% answered "all of the time."

Teachers were also surveyed on project outcomes. The following chart shows some of their responses:

Question	Before Mobile Technology Project	After MT Project
"I feel supported with technology related professional development opportunities in the division."	59% of teachers agreed or strongly agreed.	86% of teachers agreed or strongly agreed.
"The use of computers and digital technologies in class helped to engage my students in their learning."	44% strongly agreed.	87% strongly agreed.
"In the past how often have you had the opportunity to use computers, digital cameras, digital video cameras and other technologies to help with your project work?"	18% answered "all of the time."	50% answered "all of the time."
	18% said "rarely" or "never."	0% said "rarely" or "never."
"Do you think that integrating computers and digital technologies into your lessons will help to support the inquiry process?"	88% said yes.	100% said yes.

Teachers reported that improved access to mobile technology gave their students opportunities to represent their learning in different ways. Teachers also commented that students were better able to share what they had learned, that the quality of students' work increased, and that they were better able to demonstrate their creativity. Many teachers commented on changes in the classroom environment: students with behavior problems became engaged and were not a negative influence on their classmates. Some teachers reported on the collaborative skills their students developed, and suggested that the students' work using the laptops was a more meaningful and authentic way for the students to represent their knowledge. Finally, teachers remarked on how the use of laptops in the classroom helped their students to work independently. The report notes that even Grade 1 students became extremely independent and confident, performing multiple tasks on their laptops.

> "We had more sustained time to work on the inquiry project... Students were more engaged and for longer periods of time. Students were able to see the results of their work quicker without having to wait until their next computer class time in another room. I didn't need to have review times to go over what was done and what to do when we have quicker access to the laptops and the students' work." –A Rocky View teacher

Teachers reported that after the project concluded, they were more confident with technology use, and that they could observe the same effect in their students. Some teachers remarked that their students learned to use the technology more quickly than the teachers, that the pace of learning was too quick for teachers, and that they would have benefitted from more technology professional development at the outset of the project. Teachers also reported that the support they received was excellent, but that more "man-power" would have been beneficial to the project. Teachers remarked that the team planning and team teaching were beneficial.

Recommendations

Based on its project, Rocky View made the following recommendations:

1. Teachers stated that embedded professional development in the classroom was the most effective to initiate a change in practice.
2. Teachers also felt very strongly that the facilitator of this project played an important role, but that the project as a whole would have benefitted from more staff.

Detailed Project Descriptions by Theme: Voice over Internet Protocol (VoIP)

Battle River School Division

Voice over Internet Protocol (VoIP)		
District	*Project Title*	*Project Description*
Battle River School Division	Communication in the 21st Century	Expanded current VoIP solution to link nine more schools within the jurisdiction. Focused on enhancing parent-school communications, operational cost savings, and the synchronization of school clocks and bells.

Project Implementation

Battle River School Division implemented a VoIP project in nine schools in the jurisdiction. Its VoIP installation included features such as four-digit calling; call park, call transfer, call pickup, call forward, call waiting, and call display; and a messaging system consisting of Unity voicemail and Microsoft exchange messaging. In total, the Battle River Division office and the Instructional Services Centre, nine schools, and several videoconferencing sites have all been linked with VoIP. The technology department was trained by the vendor, and the division then carried out its own training of other staff. The schools received approximately four hours of training and a quick reference guide that had been customized for the jurisdiction.

Outcomes

Research on the effects of the project in district schools was conducted in the form of a survey, and 40 responses were received out of 62 mailed out (a response rate of 64.5%). Principals, secretaries, teachers, counselors, and librarians responded to this survey. The chart that follows shows these respondents' satisfaction with the VoIP phone system.

Satisfaction level	Job description of respondent					Total for all respondents
	Administrator	Secretary	Librarian	Counselor	Teacher	
Very Satisfied	7 (58.33%)	6 (54.55%)	3 (33.33%)	4 (66.67%)	1 (50%)	21 (52.5%)
Satisfied	2 (16.67%)	4 (36.36%)	2 (22.22%)	1 (16.67%)	1 (50%)	10 (25%)
Somewhat Satisfied	3 (25%)	1 (9.09%)	4 (44.44%)	1 (16.67%)	0	9 (22.5%)
Not Satisfied	0	0	0	0	0	0
Total	12	11	9	6	2	40

As this chart shows, 52.5% of the 40 total respondents reported they were "very satisfied" with the VoIP system, 25% of respondents said they were "satisfied," and 22.5% said they were "somewhat satisfied." None of the 40 respondents reported being "not satisfied."

In particular, Battle River reported the following benefits from their VoIP installation:

- Support for individualized voice messaging. Battle River's unified messaging system consists of Unity voicemail and Microsoft Exchange messaging. Each principal, vice principal, secretary, librarian, counselor, and student support person received their own messaging. As well, voicemail and e-mail messaging were integrated so users could get their voicemail by phone or by e-mail. 92.5% of staff surveyed felt that voicemail has enhanced the communication between school and parents;
- VoIP and intercom integration, and synchronization of school clocks and bells. The synchronization of clocks and bells allowed schools offering classes via videoconferencing to operate on the same schedule. At the time of this report's writing, Battle River is investigating the possibility of integrating its VoIP system with new intercoms, something that was not part of the original proposal;
- Full featured phone system including call park, call transfer, call pickup, call forward, call waiting, call display, speed-dialing, etc;
- Four-digit calling between schools and the central office. This service reduced the amount of time secretaries spend directing calls. As well, four-digit calling allowed for the creation of divisional directories; and

- Cost savings, including savings for leased lines and long distance calling. In Phase I of the project, 36 analog lines were replaced with a single 23-channel PRI and six backup lines. Cost savings from Phase I were estimated at $650/month. In Phase II, lines were consolidated and removed. This resulted in a cost savings of $550/month. In Phase III, VoIP services were added to three additional schools and handsets were added to videoconferencing suites. One land-line was removed from each of these three schools, for an additional savings of $62/month.

Recommendations

Battle River recommended the following elements to ensure a successful VoIP implementation:

1. Effective user training. The "train the trainer" approach taken by Battle River was not altogether successful. Most of the office staff are now comfortable with the VoIP system, but the report notes, "it is easy to look at the results of our survey and determine which people were trained by the tech department and which were trained locally." 48% of users in Battle River schools felt they could use more training. Battle River is currently scheduling additional training sessions to solve this problem.
2. Consideration of VoIP call prefixes. When dialing an outside line, the VoIP system requires a prefix digit in front of the number. Industry standard has typically been "9" as the prefix digit. However, this caused some issues with users accidentally dialing 9-1-1. Therefore, Battle River recommends selecting a different number and it has already made this change.

Foothills School Division

Voice over Internet Protocol (VoIP)		
District	*Project Title*	*Project Description*
Foothills School Division	IP Convergence	Expanded on the jurisdiction's Cisco VoIP solution to new sites, and included a converged solution in providing voice, media, intercom and bell systems over IP.

Project Implementation

The Emerging Technologies initiative allowed Foothills School Division to expand on its existing VoIP system to add new sites and more functionality. In its proposal, Foothills indicated it would add at least ten new VoIP sites to its existing installation, add an additional media server, and test a system with IP-integrated intercom and bells.

The goals of this project were:

- To increase power of and access to communication by all users within Foothills School Division;
- To reduce overall costs and support processes;
- To increase access to multimedia resources; and
- To determine the feasibility of an IP-based intercom system.

VoIP phones were added to two new school sites that were constructed concurrently with the project. Foothills also expanded the services available over its network, with the addition of a centralized, remotely-accessible server for digital media. As well, IP-based intercom and bell systems were fully deployed and tested in Foothills schools, and ultimately rejected as a solution. The intercom and bell systems tested introduced a range of problems including missed bells, IP speakers losing connectivity, volume control issues, and other problems.

By the end of June 2008, every school in Foothills School Division will be using VoIP. Foothills, supported by its Learning Services department, is also involved in ongoing professional development to increase the district's commitment to, and capacity for, VoIP and video streaming. By summer 2008, Foothills also hopes to have contractual agreements with media providers in place to allow for media streaming from a central server to division desktops. Foothills is also involved in ongoing consultation with its vendor, with the hopes that a strategy for using multicasting can be developed. It hopes to have a multicasting solution in place by the end of the 2007/2008 school year.

Outcomes

Foothills reported the following outcomes from the VoIP/media streaming project:

- VoIP was successfully implemented at 26 sites by adding jurisdictional funding to the original grant proposal. All schools with VoIP systems include handsets at each desk, individual voice mail boxes, and five-digit internal dialing;

- Foothills observed a substantial decrease in the cost of telephone line charges and long distance costs district-wide; cost savings are established at $2,830.26 per month in reduced line charges. Long distance savings are not included in this cost;
- Foothills explored the possibility of using a system of IP-integrated intercoms and bells;
- Foothills' final report notes that in addition to accumulated cost savings, the long-term benefits of its VoIP implementation will also include increasing feature richness as the technology develops, which will provide further, unanticipated benefits.

Recommendations

Based on its IP Convergence project, Foothills emphasized the importance of the following steps in educational VoIP implementations:

1. Reviewing IP-based scheduling and intercom systems in a SuperNet environment once multicasting is in place, as the chosen solution did not work in its initial deployment.
2. Expectation of a learning curve for the implementation of VoIP technology.
3. Budgeting for a complete network traffic analysis in order to ensure the reliability of transmissions.
4. Consider traffic management strategies to deal with increased demands on an IP-based network.
5. Reviewing, and agreeing on, bandwidth implications prior to deployment.
6. Planning for time and effort required for both the installation and the ongoing administration of VoIP systems.
7. Implementation of rigorous, detailed documentation strategies for bandwidth, network modifications, switch configurations and inventory.
8. Mapping out 9-1-1 calling and dialing schemes before project implementation.
9. Establishing primary contact with Telco providers to coordinate PRI line and 9-1-1 calling strategies.
10. Ensuring redundant call managers are in place in geographically diverse locations.
11. Developing a deployment strategy for associated hardware (especially handsets).
12. Ensuring that administration at the district and schools levels are aware of the full functionality of IP-based technology.

Horizon School Division

Voice over Internet Protocol (VoIP)		
District	*Project Title*	*Project Description*
Horizon School Division	Implementing Voice over IP Technologies to Enhance Collaboration of Teachers, Administrators and Parents in the Horizon School Division	Implemented a core VoIP system infrastructure to support the addition of incremental features and systems as schools are modernized in phases over time.

Project Implementation

Horizon School Division's VoIP initiative focused on the acquisition of VoIP phones and the enhancement of technology skills and competencies of school and jurisdiction administrators. This initiative allowed the division to explore new forms of communication using its Wide Area Network (WAN). Horizon installed the core VoIP infrastructure necessary, with a Cisco VoIP capable router and two IP telephone handsets in 18 schools. It also created the capability for teacher voicemail. Horizon also replaced the Division and Maintenance offices' phone systems and the obsolete phone systems of five schools with IP systems. In these cases, every telephone was replaced with a VoIP handset. Therefore, these five schools now have IP phones in the school office and in every classroom.

Horizon continues to pursue VoIP technology with the hope that eventually all phone systems in the jurisdiction can be replaced with VoIP systems. These upgrades will occur over the coming years as its existing phone systems become obsolete and require replacement. Horizon has allocated funding in the district's five-year technology plan to ensure that funding is available for maintenance, training and expansion of the system.

Outcomes

Horizon schools were able to combine traditional phone lines and WAN lines to result in a number of cost and efficiency improvements. Specifically, it reported the following outcomes:

- Cost savings, including a reduction of long distance charges;
- The school district has the capability to give every teacher access to their own voice mailbox, increasing the efficiency for communication with parents;
- Infinite possible number of internal phone lines;
- The reduced use of traditional phones within schools leads to smaller likelihood of outside callers receiving a busy signal when calling a school;

- Communication within and between schools was also improved, as division office staff, principals, secretaries, and teachers have direct dialing to any other office or classroom in the jurisdiction;
- Transfers of phone calls could be made more effectively;
- VoIP systems can be combined with public address systems so that announcements can be made from any phone. In fact, the division's central office can make simultaneous announcements in all division schools when necessary (for example, in case of an emergency);
- VoIP phone systems include a jurisdictional directory for increased ease of accessing numbers;
- As the phones are networked, updates can be made from one central location;
- With a webcam upgrade, point-to-point videoconferencing capability can be added;
- Capacity for in-house maintenance is expanded, as additional phones and phone lines can be installed without requiring service from a telephone company. As well, the jurisdiction has developed a sufficient level of local expertise in the VoIP system that contractors are no longer required to install new components;
- The VoIP project showed the jurisdiction's willingness to experiment with new technology for students and staff;
- VoIP fulfills the district's goal of supporting rural schools by reducing communication expenses; and
- VoIP supplements Horizon's existing videoconference project. Courses provided via videoconferencing now rely on the VoIP system as a back-up.

Recommendations

Based on its VoIP installation, Horizon made the following recommendations:

1. Schools must carefully consider what they really need and want. VoIP systems are extensible, and features must be selected based on their usefulness so that system implementation costs can be assessed accurately.
2. Districts should implement VoIP systems slowly (one school at a time) to allow troubleshooting and to reduce communication downtime.
3. Schools need to consider the impact on emergency dialing, as they need to dial "9" for an outside line before dialing 9-1-1.
4. Transition time should be provided for staff to become familiar with the new technology. Horizon recommends that staff be provided with in-service training to make this transition more successful.
5. A formal date for the switch to VoIP should be chosen and adhered to. Horizon kept postponing the date as users communicated to the head office that they were not ready to switch to the new system. For a period of time, Horizon operated both VoIP and traditional phone systems while users became accustomed to the new system. However, it was discovered that users would continue to utilize the old system for as long as it was operational.

6. Schools should replace or upgrade phone systems as needed and not before. This recommendation is based on the fact that VoIP technology continues to drop in price, and substantial savings could be realized by postponing the transition.
7. Jurisdictions should create a team to evaluate the system and decide what features should be included in it. A team of people are better able to make this decision than a single person who may make choices based primarily on personal preference.
8. Jurisdictions should explore alternative vendors as cost differences in systems do exist.
9. Jurisdictions should consider their technical resources and capability, as VoIP systems do require expertise and time for planning and installation.
10. Schools should consider all costs associated with VoIP technology, including planning for the fact that some traditional phone lines will have to remain in place to make outgoing calls and for emergencies.

Detailed Project Descriptions by Theme: Web-based Collaboration Tools, Administrative and Application Infrastructure

Edmonton Catholic Schools

Web-Based Collaboration Tools, Administrative and Application Infrastructure		
District	*Project Title*	*Project Description*
Edmonton Catholic Schools	Web-Based Learner Outcome Assessment	Developed a universal interface that provides other districts with access and use of web-based student assessment software, Individual Program Plans, and e-report cards.

Project Implementation

Before the Emerging Technologies projects began, Edmonton Catholic Schools had already developed its eLuminate system, a custom-designed, in-house information management program for school districts. eLuminate consists of the eLuminate framework (the component of the system that supports student information, course information, security, and system administration) along with components for elementary and junior high student report cards, individual assessments, and Individualized Program Plans. The goal of Edmonton Catholic Schools' Emerging Technologies project was to allow other school jurisdictions in Alberta to employ this specialized application, which supports assessment for learning. The initial release of the program was to Elk Island Public Schools Regional Division, Grande Prairie Roman Catholic Separate School District, Elk Island Catholic Separate Regional Division and Red Deer Catholic Regional Division. All of these jurisdictions were in need of different reporting systems.

As part of this project, Edmonton Catholic Schools provided two training events on eLuminate for curriculum and assessment leaders and the jurisdictional technical support team. Edmonton Catholic's Learning Support Services department also developed support materials for schools as they moved to the new system.

Outcomes

The adoption of eLuminate has taken place as planned. At the time of final report submission, eight additional Alberta school authorities were using eLuminate:

Year 1 Adoptees (2006-2007)	Year 2 Adoptees (2007-2008)
• Elk Island Catholic • Elk Island Public • Red Deer Catholic • Grande Prairie Catholic	• Evergreen Catholic • Holy Family Catholic • Holy Spirit Catholic • Lakeland Catholic

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Students taking their two-year after-degree in Education at Concordia College also use the system as part of their regular course work. Approximately 4,000 Alberta teachers use the system in support of the assessment of nearly 50,000 students.

The eLuminate system is hosted by TELUS when it is used by jurisdictions other than Edmonton Catholic. Licensing is based on a per-student subscription fee. At the time of the final report's writing, there were no plans in place to change the licensing model to support self-hosted installations. Planning is underway for the implementation of a grade book component and senior high report card functionality for a limited pilot in Edmonton Catholic Schools in Fall 2008.

Edmonton Catholic reported the following outcomes that have resulted from the sharing of the eLuminate system:

- Increased collaboration between participating jurisdictions. As multiple jurisdictions have implemented the same assessment solution, unique collaborative opportunities have arisen. For example, Elk Island Public and Elk Island Catholic School Divisions collaboratively developed Key Learner Outcomes that are shared between both districts. As well, all four initial deployment participants took part in a one-day information-sharing session in December 2006;
- Growth in assessment practices. In informal surveys, jurisdictions reported that eLuminate facilitated assessment for learning; and
- Increased student record standardization. Districts have re-structured their student data, including student and teacher IDs, standardized elementary courses, and made their data entry practices consistent.

Recommendations

Edmonton Catholic made the following recommendations:

1. Involvement of school administrative assistants is critical to ensure that systems integration is as smooth as possible.
2. Systems integration should occur in the spring, well before going live in September.
3. Participating jurisdictions should take at least one year to lay the groundwork in their assessment practices before deploying the new system to maximize the advantages of eLuminate as a tool to support assessment for learning.
4. While the human resource plan should be tailored to fit every jurisdiction's unique environment, some key factors should be considered:
    - Jurisdictions with highly visible project sponsors – who were typically educators, not technologists – reported the smoothest implementations.
    - Jurisdictions that designated educators as primary points of technical contact were able to spread out the workload, minimize risk, and proactively manage the effects of the change to the new system.
    - These primary contacts typically assumed a high degree of responsibility for either providing or arranging training, and served as their district's primary point of contact for technical support.

- Jurisdictions that delegated data integration responsibilities to one or more staff members familiar with the student records environment were further able to balance workloads and mitigate risk.

Peace Wapiti School Division

Web-Based Collaboration Tools, Administrative and Application Infrastructure		
District	*Project Title*	*Project Description*
Peace Wapiti School Division	Peace Region Education Portal (PREP)	Implemented a portal to address the district's need for access, accountability, and efficiency in teaching and learning.

Project Implementation

Peace Wapiti School Division's Emerging Technologies project was centered around the creation of the Peace Region Educational Portal (PREP). PREP was intended to be an educational portal developed with portal software in co-operation with a software vendor. The intention of PREP was to facilitate collaboration and human interaction using a single, standard platform to connect students, teachers, administrators and parents with educational information, tools and processes.

Attempts to implement PREP were unsuccessful. At the time of final report submission, the portal was not functioning as initially conceived. Beginning in December 2005, with the initial implementation, the district experienced problems with the functionality and stability of the portal software. Implementation delays also occurred. Professional development was ongoing throughout the first year of the project; however, this professional development was of limited use as staff had sporadic access to the software itself. As of September 2007, the vendor had been advised that Peace Wapiti School Division would not be proceeding with the implementation.

> "I enjoy working collaboratively with several teachers in focus groups. We are very productive in terms of creating useful tools to use in the classroom to help achieve better results for students. These are shared and discussed on the Moodle site and keep the work going between meetings." –A Peace Wapiti School Division teacher

However, as the portal was under development, the open-source course management system Moodle was installed as a temporary measure. The Moodle site was prepared in December 2006, and was in use almost immediately. At the time of final report submission, the Peace Wapiti School Division Moodle site was still being used, and had become a very successful collaboration tool for Alberta Initiative for School Improvement (AISI) coordinators, teachers, Technology Committee members, and school administrators. In light of the use of Moodle, Peace Wapiti School Division judged the collaborative and educational aspects of their project very successful.

Outcomes

The following outcomes arose from Peace Wapiti's PREP/Moodle project:

- Peace Wapiti School Division reported that by November 2007, its Moodle site was home to 20 active professional learning community collaboration spaces, with 282 new users having created accounts and accessed suites since September 2007;
- Members of the professional learning community were using the site to share documents, discuss ideas, co-author materials and develop e-portfolios. According to the report, "the site encourages increased collaboration and communication in building communities of practice; increased knowledge and content sharing; individualized learning; improved productivity and classroom efficiency; and increased professional development;"
- The Peace Wapiti School Division Moodle site was also being used as a learning management system, with Biology 20, Chemistry 20 and Physics 20 courses all being offered completely online through Moodle; and
- The site was also being used to host other digital resources, including materials for four blended learning courses and two school websites.

Recommendations

The Peace Wapiti School Division made the following recommendations based on its Emerging Technologies project:

1. Being resilient and relentless in pursuing established goals and in focusing on the needs of students and teachers. Its report notes, "The focus on the educational goals, and the recognition that the technology is merely a support structure, adds credibility to the professional learning communities and integrity to the processes that the coordinators and teachers are engaged in."
2. Clearly, flexibility was required to make the decision to pursue an alternative when the PREP portal, as initially conceived, failed. One teacher involved in the project noted, "I appreciate that decisive action was taken [in implementing Moodle] to finding a functional way to communicate our ideas." The jurisdiction's decision to implement an alternative resulted in what Peace Wapiti School Division identifies as "a major success."

Pembina Hills Schools Division

Web-Based Collaboration Tools, Administrative and Application Infrastructure		
District	*Project Title*	*Project Description*
Pembina Hills Regional Division	Anti-Spam Technology as a Shared Service over SuperNet	Used SuperNet to provide anti-spam technologies for partner jurisdictions to reduce the amount of unsolicited e-mail.

Project Implementation

Pembina Hills Regional Division implemented the eW@LL anti-spam solution from Gennux Microsystems to reduce the amount of unsolicited e-mail received in the jurisdiction. Since its implementation in Spring 2006, eW@LL has been running as the anti-spam solution for Pembina Hills, Sturgeon Schools, Alberta Distance Learning Centre, and Elk Island Catholic Schools. This program presented the first opportunity for these jurisdictions to co-operate, and each jurisdiction completed the implementation in its own way. One planned an in-service professional development event to ensure that its staff understood the program and its use, while another simply set up the client and "waited to see what would happen."

The eW@LL software looks at the header of an e-mail message, not its content, to determine whether it is SPAM. The program verifies senders' e-mail addresses to verify their authenticity as a means of filtering out unsolicited e-mail. Because it does not depend on the use of rules-based filters or scoring of content, the program requires no subscriptions or updates.

In spite of the differences in how eW@LL was implemented, Pembina Hills reported that the program was a success in each of the jurisdictions.

Outcomes

Pembina Hills noted the following advantages of the software and its implementation:

- eW@LL allows e-mail users to manage and maintain their own individual preferences. It also allows different jurisdictions to share a common anti-spam server, while still setting their own preferences for filtering. Each jurisdiction's configurations and authentication schema is unique;
- Because it is web-based, this anti-spam client facilitates remote access to e-mail without requiring the installation of any local software;
- Because spam e-mail traffic is limited to the anti-spam server, school jurisdictions' local networks and SuperNet connections are not impacted. This resulted in a considerable traffic savings in the participating jurisdictions (except in Sturgeon School Division, where the mail server was located);
- Among the users who activated their eW@LL accounts in participating jurisdictions, almost 19 million spam messages were identified and were never transmitted to the destination network. This resulted in time savings for technology staff in each jurisdiction. Before the implementation

of this project, IT staff in each jurisdiction were involved in maintaining their own anti-spam services. In some jurisdictions, according to Pembina Hills, this maintenance amounted to 0.2 FTE. After the eW@LL system was implemented, time savings were significant. Months would often go by in which system administrators were not required to even log in to the system; and

- The project goal of shared anti-spam over the SuperNet was partially realized. Early in the project implementation, it was discovered that sharing services over SuperNet would require a unique virtual private network, and in many cases, setting up this service would require more expert knowledge on network routing systems at each partner jurisdiction. Therefore, the service was shared via an Internet connection over SuperNet.

Recommendations

Pembina Hills made the following recommendation based on its anti-spam implementation:

1. The system works well as a single server shared amongst jurisdictions and reduced administrative overhead for e-mail. However, it notes that a key aspect of such an implementation is that jurisdictions must be willing to work on a shared server. This proved to be an obstacle for some jurisdictions, who decided not to participate in the project because of their unwillingness to have their mail on a remote server.

Detailed Project Descriptions by Theme: Leadership in Technology Integration

Calgary Catholic Schools

Leadership in Technology Integration		
District	*Project Title*	*Project Description*
Calgary Catholic Schools	Technology Leadership Program and Technology Learning Centre	Implemented a technology leadership program (TLP) for 30 identified district leaders. The TLP allowed leaders to be involved in intensive professional development for technology leadership.

Project Implementation

The Calgary Catholic School District developed a Technology Leadership Program (TLP) and Technology Learning Centre (TLC), which created an environment to develop technology leadership skills and supported the development and implementation of other technology-based learning programs in the jurisdiction's schools. These projects include 2Learn.ca, videoconferencing, the Emerge One-to-One Laptop Learning initiative, and Science & Technology Schools. The TLC was equipped with wireless infrastructure and tablet laptops, an electronic whiteboard, and other equipment.

The Technology Leadership Program accepted applicants from interested administrators and supervisors within the Calgary Catholic School District. The Technology Leadership Program group included participants with some experience using educational technology and a desire to grow in this area. The members of the Technology Leadership Program were provided with learning management system accounts to facilitate communication and collaboration. This group met on an ongoing basis to discuss the three core areas of (a) learning, (b) leadership and (c) technology. These meetings included workshops and activities, and in some cases collaboration with consultants. Professional development workshops are ongoing as of the 2007/2008 school year.

The Technology Leadership Program is also associated with the 2Learn.ca teacher leader group, in which participants in the Technology Leadership Program were asked to nominate a teacher from their school to apply for one of 10 teacher leader positions. These teacher leaders support the technology leadership action research projects in their schools, work with administrators to provide professional development, and work with the school steering committee.

This project also established the St. Paul Technology Learning Centre, which serves as a wireless test site and meeting site for district personnel and projects.

Outcomes

Calgary Catholic Schools reported the following outcomes from this project:

- Development of a core group of 40 technology leaders to develop and maintain the district's vision of educational technology integration;
- An increase in the technological expertise of the Instructional Services department, and a corresponding increased capacity for technology-rich professional development;
- Increased capacity and support for technology-based initiatives in jurisdiction schools, including mobile computing, videoconferencing, and learning management systems;
- Increased confidence of participating administrators in envisioning and guiding technology integration;
- Increased use of technology for professional development, and for the use of internal committees;
- Use of the Technology Learning Centre's wireless infrastructure as a model and test-site for wireless installations in district schools;
- Use of the Technology Learning Centre facility by outside groups, and recognition of the program outside the district;
- Increased availability of feedback from users;
- Increased possibility for professional networking; and
- Increased demand among participants for access to wireless infrastructure and learning management systems beyond the life-span of the project, due to the observed positive impact on productivity. District planning is in place to increase learning management system access during the 2007/2008 school year.

> "Our IS [Instructional Services] department's expertise is trickling down to the school level. They are not only able to support and motivate our teachers who are working with technology, but they are also able to expose the variety of technologies to many of our less techie teachers."

Recommendations

After the completion of this two-year program, the project team made the following recommendations:

1. Continuing support for the Technology Learning Centre and the Technology Leadership Program, including a larger number of schools in the program.
2. Ongoing efforts to ensure that technology-rich professional development continues.
3. Ongoing policy change at the district level to ensure that technological changes are sustained.
4. Increased communication throughout the District about Technology Leadership Program leaders to allow for greater diffusion of knowledge beyond the project group.

5. Conclusion

As technology becomes increasingly embedded in the learning process within jurisdictions, technology leadership and research will play a key role in the re-shaping of the learning landscape. Alberta Education conducts research into emerging technologies and best practices in classroom technology use. These findings are then shared within the department and the K-12 school system to allow for better decision-making on technology implementation and teaching practices.

The projects completed as part of the Emerging Technologies in the 21st Century initiative were limited by their short duration and the preliminary nature of the investigations being performed. However, these projects nonetheless provided valuable insight into the roles emerging technologies can play in schools and districts, and how they can affect teaching and learning. The outcomes of these projects will continue to inform future projects and research.